

WHAT IS CLAIMED IS:

- 5 1. A semiconductor laser device comprising:
a first mount;
a second mount formed by a heat sink having a heat conductivity of 500
W/(m*K) or more and joined to the first mount through a first multi-layer film
including a gold thin film; and
10 a semiconductor laser element joined to the second mount through a second
multi-layer film including a gold thin film, said semiconductor element having a
diffraction grating, an emission edge, a reflection edge and an active layer,
wherein said semiconductor laser element is configured to output a laser beam
having a plurality of oscillation longitudinal modes through the emission edge, and
15 the plurality of oscillation longitudinal modes are output in accordance with a
wavelength selection characteristic of the diffraction grating formed between the
emission edge and the reflection edge and nearby the active layer.
- 20 2. The semiconductor laser device according to claim 1, further
comprising:
a third mount joined to the first mount through a third multi-layer film
including a gold thin film; and
a temperature measuring element joined to the third mount through a fourth
multi-layer film including a gold thin film and configured to measure a temperature of
25 the semiconductor laser element.
3. The semiconductor laser device according to claim 2, wherein:
the second mount comprises diamond.
- 30 4. The semiconductor laser device according to claim 3, wherein:
the second mount is configured to minimize heat resistance relative to a
semiconductor laser element length, width and thickness.

5. The semiconductor laser device according to claim 4, wherein:
the second mount has a thickness of at least 0.4 mm, a length of at least 3.2 mm and a width of at least 3.2 mm when the semiconductor laser element is
5 configured to have a thickness of not more than 0.13 mm, a length of not more than 3.2 mm and a width not more than of 0.35 mm

6. The semiconductor laser device according to claim 4, wherein:
the second mount has a thickness of at least 0.3 mm, a length of at least 2.7
10 mm and a width of at least 1.0 mm when the semiconductor laser element is configured to have a thickness not more than of 0.13 mm, a length of not more than 2.7 mm and a width of not more than 0.35 mm

7. The semiconductor laser device according to claim 3, wherein:
15 the second mount comprises a polycrystal diamond.

8. The semiconductor laser device according to claim 1, further comprising:
a temperature measuring element joined to the first mount through a third
20 multi-layer film including a gold thin film and configured to measure a temperature of the semiconductor laser element.

9. The semiconductor laser device according to claim 8, wherein:
the second mount comprises diamond.
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10. The semiconductor laser device according to claim 9, wherein:
the second mount is configured to minimize heat resistance relative to a semiconductor laser element length, width and thickness.

11. The semiconductor laser device according to claim 10, wherein:
the second mount has a thickness of at least 0.4 mm, a length of at least 3.2 mm and a width at least of 3.2 mm when the semiconductor laser element is
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configured to have a thickness not more than of 0.13 mm, a length of 3.2 mm and a width not more than of 0.35 mm

12. The semiconductor laser device according to claim 10, wherein:
5 the second mount has a thickness of at least 0.3 mm, a length of at least 2.7 mm and a width of at least 1.0 mm when the semiconductor laser element is configured to have a thickness of not more than 0.13 mm, a length of 2.7 mm and a width of not more than 0.35 mm

10 13. The semiconductor laser device according to claim 9, wherein:
the second mount comprises a polycrystal diamond.

14. The semiconductor laser device according to claim 9, wherein:
the second mount is covered with a metallic foil including a gold thin film.

15 15. The semiconductor laser device according to claim 1, further comprising:

a temperature measuring element joined to the second mount through a third multi-layer film including a gold thin film and configured to measure a temperature of
20 the semiconductor laser element.

16. A semiconductor laser module comprising:
a semiconductor laser device having
a first mount,
25 a second mount formed by a heat sink having a heat conductivity of 500 W/(m*K) or more and joined to the first mount through a first multi-layer film including a gold thin film, and
a semiconductor laser element configured to emit a laser beam having a plurality of oscillation longitudinal modes, joined to the second
30 mount through a second multi-layer film including a gold thin film, and having a diffraction grating, an emission edge, a reflection edge and an active layer, wherein

the plurality of oscillation longitudinal modes are output in accordance with a wavelength selection characteristic of the diffraction grating formed between the emission edge and the reflection edge of the laser element and nearby the active layer of the laser element;

- 5 an optical fiber configured to guide the laser beam outside the module; and
an optical coupling lens system that couples the semiconductor laser device to the optical fiber.

17. The semiconductor laser module according to claim 16, further
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an isolator set in the optical coupling lens system and configured to suppress a return light reflected from an optical fiber side of the optical coupling lens system.

18. The semiconductor laser module according to claim 16, wherein:
15 the semiconductor laser device comprises a third mount joined to the first mount through a third multi-layer film including a gold thin film; and

a temperature measuring element joined to the third mount through a fourth multi-layer film including a gold thin film and configured to measure a temperature of the semiconductor laser element.

20 19. The semiconductor laser module according to claim 18, wherein:
the second mount comprises diamond.

20. The semiconductor laser module according to claim 19, wherein:
25 the second mount is configured to minimize heat resistance relative to a semiconductor laser element length, width and thickness.

21. The semiconductor laser module according to claim 20, wherein:
the second mount has a thickness of at least 0.4 mm, a length of at least 3.2
30 mm and a width of at least 3.2 mm when the semiconductor laser element is configured to have a thickness of 0.13 mm, a length of 1.5 mm and a width of 0.35 mm

22. The semiconductor laser module according to claim 20, wherein:
the second mount has a thickness of at least 0.3 mm, a length of at least 2.7
mm and a width of 1.0 mm when the semiconductor laser element is configured to
5 have a thickness of not more than 0.13 mm, a length of 1.5 mm and a width of not
more than 0.35 mm

23. The semiconductor laser module according to claim 19, wherein:
the second mount comprises a polycrystal diamond.

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24. The semiconductor laser module according to claim 16, wherein:
the semiconductor laser device comprises a temperature measuring element
joined onto the first mount through a third multi-layer film including a gold thin film
and configured to measure a driving temperature of the semiconductor laser element.

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25. The semiconductor laser module according to claim 24, wherein:
the second mount comprises diamond.

26. The semiconductor laser module according to claim 25, wherein:
20 the second mount is configured to minimize heat resistance relative to a
semiconductor laser element length, width and thickness.

27. The semiconductor laser module according to claim 26, wherein:
the second mount is configured to have a thickness of at least 0.4 mm, a length
25 of at least 3.2 mm and a width of at least 3.2 mm when the semiconductor laser
element is configured to have a thickness of not more than 0.13 mm, a length of 3.2
mm and a width of not more than 0.35 mm

28. The semiconductor laser module according to claim 26, wherein:
30 the second mount is configured to have a thickness of at least 0.3 mm, a
length of at least 2.7 mm and a width of at least 1.0 mm when the semiconductor laser
element is configured to have a thickness of not more than 0.13 mm, a length of 2.7

mm and a width not more than of 0.35 mm

29. The semiconductor laser module according to claim 25, wherein:
the second mount comprises a polycrystal diamond.

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30. The semiconductor laser module according to claim 25, wherein:
the second mount is covered with a metallic foil including a gold thin film.

31. The semiconductor laser module according to claim 16, wherein:
the semiconductor laser device further comprises a temperature measuring
element joined onto the second mount through a third multi-layer film including a
gold thin film and configured to measure a driving temperature of the semiconductor
laser element.

32. A semiconductor laser device comprising:
a first mount;
a second mount formed by a heat sink having a heat conductivity of 500
W/(m*K) or more and joined onto the first mount through a first multi-layer film
including a gold thin film;

a semiconductor laser element joined onto the second mount through a second
multi-layer film including a gold thin film;

means for outputting a laser beam having a plurality of oscillation longitudinal
modes in accordance with a wavelength selection characteristic of a diffraction grating
formed between an emission edge and a reflection edge of the laser element and
nearby an active layer of the laser element; and

means for suppressing a deterioration of optical output and service life of the
semiconducting laser element, including

means for measuring a temperature of the semiconductor laser element, and
means for controlling the temperature of the semiconductor laser element.

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33. A semiconductor laser module comprising:
a semiconductor laser device configured to emit a laser beam and having

- a first mount,
- a second mount formed by a heat sink having a heat conductivity of 500 W/(m*K) or more and joined onto the first mount through a first multi-layer film including a gold thin film, and
- 5 a semiconductor laser element joined onto the second mount through a second multi-layer film including a gold thin film;
- an optical fiber for guiding the laser beam outside the module;
- an optical coupling lens system for optically coupling the semiconductor laser device with the optical fiber;
- 10 means for outputting a laser beam having a plurality of oscillation longitudinal modes in accordance with a wavelength selection characteristic of a diffraction grating formed between an emission edge and a reflection edge of the laser element and nearby an active layer of the laser element;
- means for measuring a temperature of the semiconductor laser element; and
- 15 means for controlling the temperature of the semiconductor laser element.

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